

Claims:

1. An isolated DNA molecule comprising a nucleotide sequence providing one or more expression cassettes capable of directing production of two or three enzymes specific for the carotenoid biosynthesis pathway being:
  - phytoene synthase derived from plants or fungi, and
  - phytoene desaturase derived from fungi or bacteria, or
  - phytoene desaturase and  $\zeta$ -carotene desaturase derived from plants.
2. The DNA molecule according to claim 1, wherein said expression cassette comprises genes or cDNAs coding for plant or fungi phytoene synthase, for fungi or bacterial phytoene desaturase or for plant phytoene desaturase and  $\zeta$ -carotene desaturase, each operably linked to a suitable constitutive, inducible or tissue-specific promoter allowing its expression in plant cells, seeds, tissues or whole plants.
3. The DNA molecule according to claim 1 or 2, further comprising at least one selectable marker gene or cDNA operably linked to a constitutive, inducible or tissue-specific promoter sequence allowing its expression in plant cells, seeds, tissues or whole plants.
4. The DNA molecule according to any of claims 1 to 3, wherein the nucleotide sequence coding for phytoene synthase originates from plants, preferably expressed under the control of a tissue-specific promoter.
5. The DNA molecule according to any of claims 1 to 4, wherein the nucleotide sequence coding for phytoene desaturase originates from bacteria.
6. The DNA molecule according to any of claims 1 to 5, wherein the nucleotide sequence coding for phytoene desaturase is fused with a suitable plastid transit peptide encoding sequence, both of which preferably are expressed under the control of a tissue-specific or constitutive promoter.

7. The DNA molecule according to any of claims 2 to 6, wherein the selectable marker gene or cDNA is hygromycin phosphotransferase under the control of a constitutive promoter.
8. The DNA molecule according to claim 6 or 7, wherein said plastid transit peptide sequence is derived from the pea Rubisco small subunit (tp).
9. A plasmid or vector system comprising the DNA molecules according to any of claims 1 to 8.
10. A plasmid or vector system according to claim 9, which is derived from *Agrobacterium tumefaciens*.
11. A transgenic plant cell, seed, tissue or whole plant that contains a DNA molecule according to any of claims 1 to 8.
12. A transgenic plant cell, seed, tissue or whole plant according to claim 11, selected from the group consisting of eukaryotic alga, embryophytes comprising *Bryophyta*, *Peridophyta* and Spermatophyta such as *Gymnospermae* and *Angiospermae*, the latter including *Magnoliopsida*, *Rosopsida*, and *Liliopsida* ("monocots").
13. A transgenic plant cell, seed, tissue or whole plant according to claim 12, selected from the group consisting of grain seeds, with rice, wheat, barley, oats, amaranth, flax, triticale, rye, and corn being preferred; oil seeds, with *Brassica* seeds, cotton seeds, soybean, safflower, sunflower, coconut, and palm being preferred; other edible seeds or seeds with edible parts selected from the group consisting of pumpkin, squash, sesame, poppy, grape, mung beans, peanut, peas, beans, radish, alfalfa, cocoa, coffee, hemp; tree nuts, with walnuts, almonds, pecans, and chick-peas being preferred; potatoes, carrots, sweet potatoes; tomato, pepper, cassava, willows, oaks, elm, maples, apples, bananas; and ornamental flowers, with lilies, orchids, sedges, roses, buttercups, petunias, phlox, violets, and sunflowers being preferred.

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14. A method of transforming plant cells, seeds, tissues or whole plants in order to yield transformants capable of expressing all enzymes of the carotenoid biosynthesis pathway necessary to produce carotenes and xanthophylls of interest, comprising the transformation of said plant cells, seeds, tissues or whole plants with a DNA molecule according to any of claims 1 to 8, or with a plasmid or vector system according to claim 9 or 10, or with plasmids or vector systems carrying genes or cDNAs coding for plant or fungi phytoene synthase and for fungi or bacterial phytoene desaturase, or with plasmids or vector systems carrying genes or cDNAs coding for plant or fungi phytoene synthase, for plant phytoene desaturase and for plant  $\zeta$ -carotene desaturase, wherein said host plant cells, seeds or tissues selected for transformation normally are carotenoid-free.
  15. A method according to claim 14, wherein said host plant cells, seeds or tissues selected for transformation normally have a carotenoid content of 0.001 % w/w or lower.
  16. A transformed whole plant regenerated from transformants yielded according to claim 14 or 15, or parts thereof, selected from the group consisting of eukaryotic alga, embryophytes comprising *Bryophyta*, *Pteridophyta* and *Spermatophyta* such as *Gymnospermae* and *Angiospermae*, the latter including *Magnoliopsida*, *Rosopsida*, and *Liliopsida* ("monocots").
  17. A transformed whole plant or part thereof according to claim 16, selected from the group consisting of grain seeds, with rice, wheat, barley, oats, amaranth, flax, triticale, rye, and corn being preferred; oil seeds, with *Brassica* seeds, cotton seeds, soybean, safflower, sunflower, coconut, and palm being preferred; other edible seeds or seeds with edible parts selected from the group consisting of pumpkin, squash, sesame, poppy, grape, mung beans, peanut, peas, beans, radish, alfalfa, cocoa, coffee, hemp; tree nuts, with walnuts, almonds, pecans, and chick-peas being preferred; potatoes, carrots, sweet potatoes, tomato, pepper, cassava, willows, oaks, elm, maples, apples, bananas; and ornamental flowers, with lilies, orchids, sedges, roses, buttercups, petunias, phlox, violets, and sunflowers being preferred.

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18. A transformed whole plant or part thereof according to claim 17 being rice.

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